

Health Consultation

Gebber's Farms, Inc. Brewster, Okanogan County, Washington

June 22, 2000

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**Prepared by
Washington State Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry**



Foreword

The Washington State Department of Health (DOH) has prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This Health Consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this Health Consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. The Health Consultation allows DOH to respond quickly to a request from concerned residents for health information on hazardous substances. It provides advice on specific public health issues. DOH evaluates sampling data collected from a hazardous waste site or industrial site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health.

For additional information or questions regarding DOH, ATSDR or the contents of this Health Consultation, please call the Health Advisor who prepared this document:

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Glossary

Acute	Occurring over a short period of time. An acute exposure is one which lasts for less than 2 weeks.
Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Chronic	A long period of time. A chronic exposure is one which lasts for a year or longer.
Oral Reference Dose (RfD)	An amount of chemical ingested into the body (i.e., dose) below which health effects are not expected. RfDs are published by EPA.
Comparison value	A concentration of a chemical in soil, air or water that, if exceeded, requires further evaluation as a contaminant of potential health concern. The terms comparison value and screening level are often used synonymously.
Contaminant	Any chemical that exists in the environment or living organisms that is not normally found there.
Dose	A dose is the amount of a substance that gets into the body through ingestion, skin absorption or inhalation. It is calculated per kilogram of body weight per day.
Environmental Media Evaluation Guide (EMEG)	A concentration in air, soil, or water below which adverse non-cancer health effects are not expected to occur. The EMEG is a <i>comparison value</i> used to select contaminants of potential health concern and is based on ATSDR's <i>minimal risk level</i> (MRL).

U.S. Environmental Protection Agency (EPA)	Established in 1970 to bring together parts of various government agencies involved with the control of pollution.
Exposure	Contact with a chemical by swallowing, by breathing, or by direct contact (such as through the skin or eyes). Exposure may be short term (acute) or long-term (chronic).
Groundwater	Water found underground that fills pores between materials such as sand, soil, or gravel. In aquifers, groundwater often occurs in quantities where it can be used for drinking water, irrigation, and other purposes.
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Lowest Observed Adverse Effect Level (LOAEL)	LOAEL's have been classified into "less serious" or "serious" effects. In dose-response experiments, the lowest exposure level at which there are statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.
Minimal Risk Level (MRL)	An amount of chemical that gets into the body (i.e., dose) below which health effects are not expected. MRLs are derived by ATSDR for acute, intermediate, and chronic duration exposures by the inhalation and oral routes.
No apparent public health hazard	Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

No Observed Adverse Effect Level (NOAEL)	The dose of a chemical at which there were no statistically or biologically significant increases in frequency or severity of adverse effects seen between the exposed population and its appropriate control. Effects may be observed at this dose but were judged not to be "adverse."
Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides which are not easily dissolved in water.
Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.
Indeterminate public health hazard	Sites for which no conclusions about public health hazard can be made because data are lacking.
Remedial investigation	A study designed to collect the data necessary to determine the nature and extent of contamination at a site.
Risk	The probability that something will cause injury, linked with the potential severity of that injury. Risk is usually indicated by how many extra cancers may appear in a group of people who are exposed to a particular substance at a given concentration, in a particular pathway, and for a specified period of time. For example, a 1%, or 1 in 100 risk indicates that for 100 people who may be exposed, 1 person may experience cancer as a result of the exposure.
Reference Dose Media Evaluation Guide (RMEG)	A concentration in air, soil, or water below which adverse non-cancer health effects are not expected to occur. The EMEG is a <i>comparison value</i> used to select contaminants of potential health concern and is based on EPA's oral reference dose (RfD).

**Volatile
organic
compound
(VOC)**

An organic (carbon-containing) compound that evaporates (volatilizes) easily at room temperature. A significant number of the VOCs are commonly used as solvents.

Background and Statement of Issues

The Washington State Department of Health (DOH) prepared this health consultation in response to a request from the Department of Ecology (Ecology) to evaluate exposure dose calculations for manganese in groundwater outlined in a previous health consultation prepared for the Gebber's Farm site dated November 25, 1997. In addition, Ecology also indicated that a contractor data reporting error was identified (soil concentrations of DDT were transcribed as DDE) in the 1991 Site Hazard Assessment (SHA). This health consultation will evaluate exposure using the correct DDT concentration, as well as evaluate the extent of environmental sampling data for the Gebber's Farm site.

The Gebber's Farm dump site is located approximately three miles east of the town of Brewster, in Okanogan County, Washington (Figure 1). Various chlorinated pesticides were disposed of in unrinsed empty and partially filled containers.¹ Ecology site files indicate that up to 1,225 gallons of waste (per year) was disposed of over a fifteen year time period.² Ecology is presently drafting an order requiring a Remedial Investigation/Feasibility Study (RI/FS), and drinking water sampling program for the Gebber's Farm site. The DOH prepared two previous health consultations for the Gebber's Farm site. The first health consultation was completed in August 1997, and the second health consultation was completed in December 1997.^{3,4}

During April 1991, a SHA was conducted for the Gebber's Farm site in order to provide preliminary characterization of hazardous wastes, and to gather sufficient data for scoring the site using the Washington Ranking Method (WARM) model. During field sampling of the site, soil samples (Figure 2) were collected from three on-site borings (two borings at a depth of 10 feet, and the third boring at 5.5 feet deep).³ A single groundwater sample was collected from the tap of a migrant worker trailer that was provided drinking water from a nearby supply well. Results of the SHA indicated that chlorinated pesticides were present in both soil and groundwater.⁴

The initial health consultation (August 1997) concluded that migrant workers and their families using a nearby supply well may have been exposed to the herbicide dinoseb. This was based upon a single groundwater sample (0.3 µg/L) collected from the supply well during 1991. Although dinoseb was detected in the groundwater sample, adverse health effects (carcinogenic or non-carcinogenic) were not anticipated to occur in the exposed migrant workers or their families.⁵ In addition, a number of pesticides were also detected in on-site soils including: 4,4'-DDT; 4,4'-DDD; 4,4'-DDE; dieldrin; endosulfan; and endrin. Following contaminant exposure evaluation, adverse health effects were not expected to occur from exposure to the contaminants listed above.

The second health consultation (December 1997) was based upon follow-up sampling of the supply well on the Gebber's Farm site during May 1997 (one sample) for volatile organic compounds (VOCs), pesticides, and metals. Although neither VOCs or pesticides were present in the groundwater sample, results indicated that copper, iron, manganese, and zinc were present. Manganese was the only metal detected which exceeded a contaminant screening value.

Discussion

Contaminants of concern for the Gebber's Farm site were selected based upon very limited environmental sampling data. Existing environmental data has not adequately characterized the site (two supply well samples). Additional characterization of the extent of contamination is necessary to adequately evaluate the public health implications of potential exposure to contaminated groundwater (on-site and off-site) and exposure to on-site soils.

Contaminants of concern were determined and evaluated (in both previous health consultations) by comparing concentrations of contaminants (in soil and groundwater) to ATSDR comparison (screening) values. Contaminants of concern for the Gebber's Farm site are listed in Table 1 in the appendix. If a contaminant exceeds a comparison value in any single environmental media (soil or groundwater) it is considered to be a contaminant of concern, and evaluated further in all site specific environmental media. Contaminants of concern may actually not represent a public health hazard, but are evaluated further using health-based guidelines. Table 2 in the appendix indicates whether estimated exposure exceeds health-based guidelines.

After considering site specific factors, exposure dose estimates are compared to health-based guidelines. Minimum Risk Levels (MRLs) or Environmental Protection Agency (EPA) Reference Doses (RfDs) are compared to exposure dose estimates to determine if adverse health effects are likely to occur from exposure to contaminant concentrations present in soil or groundwater. MRLs are estimates of daily human exposure to a chemical that is not likely to result in non-cancer adverse health effects over a specified duration of exposure. MRLs are derived by ATSDR, and are based upon systemic non-carcinogenic health effects. A comparison of estimated exposure doses to MRLs or RfDs, and other information allows for evaluation of potential health effects which may result from exposure to on-site soils or groundwater at the Gebber's Farm site.

Exposures greater than the MRL will not necessarily result in a threat of adverse health effects. When the calculated dose is above the MRL, available epidemiologic and toxicologic data are evaluated to determine the potential for adverse health effects occurring from exposure. If an MRL is not available, an RfD is used. RfDs are derived by EPA, and represent estimates of daily exposure to a chemical that are not likely to result in adverse non-carcinogenic health effects. If the calculated exposure dose is below the MRL the conclusion is usually that non-cancer health effects are not likely. It is important to note that simply because a calculated exposure dose exceeds an MRL a health threat does not necessarily exist.

If an estimated daily exposure dose exceeds an MRL or RfD, the dose is compared to No Observed Adverse Levels (NOAELs) and Lowest Observed Adverse Effect Levels (LOAELs) from various animal and, if available, human studies to determine if health effects are likely to occur from a specific exposure dose. The actual toxic effect levels can be established at the LOAEL or NOAEL. The LOAEL represents the lowest dose at which an adverse health effect is observed, and the NOAEL represents the highest dose that did not result in an adverse health effect.

Groundwater

Exposure to potentially contaminated groundwater depends upon use of the contaminated wells. A supply well located within 100 yards of the Gebber's Farm dump site provides drinking water to farm worker housing units (mobile homes) inhabited by migrant farm workers and their families. Presently there are 8 mobile homes located on-site; however, the number of individuals living in the mobile homes is unknown. Migrant workers and family members (including children) are thought to inhabit the mobile homes throughout the year.⁶

Surface Soil/Sub-surface Soil

Contaminated sub-surface soil may be exposed if contaminated areas are excavated and become surface soils. Potential routes of exposure are ingestion and dermal contact with contaminated surface soils. The extent of surface soil contamination within the Gebbers Farm dump site area is presently unknown and represents a data gap. Characterization of surface soils (0-3 inches in depth) and sub-surface soils at the Gebbers Farm site is necessary to assess the public health implications of the soil pathway.

Public Health Implications

In order to evaluate the potential for non-cancer adverse health effects resulting from exposure to contaminated soil or groundwater, a dose is estimated for each contaminant of concern. Exposure doses are calculated for site-specific scenarios in which migrant workers and family members might come into contact with contaminated soils and groundwater at the Gebber's Farm dump site.

Manganese

Manganese may be released to water by discharge from industrial facilities or as leachate from landfills and soil. Land disposal of manganese-containing wastes is the primary source of manganese releases to soil.⁷ Manganese was detected in a single groundwater sample collected from a supply well on-site at a concentration of 103 µg/L. Under a residential exposure scenario, the highest estimated exposure dose for a child ingesting manganese contaminated drinking water would amount to an oral exposure dose of 0.0103 mg/kg/day (based upon the typical weight of one year old child of 10 kg and an average ingestion of 1 liter of water per day). The estimated daily exposure dose calculated for a child ingesting manganese contaminated groundwater does not exceed (is 13 times less than) the EPA health-based guideline (RfD) for manganese of 0.14 mg/kg/day.⁸

However, according to the EPA Integrated Risk Information System (IRIS), when evaluating manganese exposure from food a modifying factor of 1 is recommended. When evaluating exposure to manganese from drinking water or soil a modifying factor of 3 is recommended.⁹ A modifying factor of 3 is used in this case because, although toxicity has not been demonstrated, there is a concern for infants fed formula that typically has a much higher concentration of

manganese that human breast milk.¹⁰ If powdered formula is prepared with drinking water, the manganese in the drinking water represents an additional source of manganese intake.¹¹ There is also evidence that newborn children absorb more manganese from the gastrointestinal tract, are less able to excrete absorbed manganese, and in newborn children absorbed manganese more easily passes the blood-brain barrier.¹² Therefore, a health-based guideline of 0.047 mg/kg/day is used for evaluating the potential for adverse health effects under a site-specific exposure scenario. Under this exposure scenario, the estimated exposure dose of a child would be more than 4.5 times less than the EPA RfD. Therefore, adverse health effects would not be expected to occur under this exposure scenario.

DDT/DDE

DDT was re-evaluated because of a laboratory reporting error that was discovered by the Ecology site manager. The reporting error transcribing DDT and DDE occurred during the SHA in 1991. The highest concentration of DDT detected in on-site soils was 190 (µg/kg) at a depth of 10 feet below ground surface. Under a worst-case residential exposure scenario, the estimated exposure dose for a child ingesting the highest concentration of DDT in sub-surface soils would amount to an exposure dose of 0.00000238 mg/kg/day (based upon a 16 kg body weight of a child).

DDT is considered to be a probable human carcinogen by EPA based upon sufficient animal studies. Although there is presently no chronic oral MRL for 4,4'-DDE, ATSDR has derived an intermediate oral MRL for DDT of 0.0005 mg/kg/day. DDT is initially metabolized in the liver to intermediary metabolites DDE and DDD, and DDE is metabolized slowly and retained in adipose tissue.¹³ The previous health consultation dated August 21, 1997, evaluated the potential for non-carcinogenic health effects using the EPA RfD for DDT of 0.0005 mg/kg/day. The EPA RfD was used due to the fact that toxicity and metabolism of DDT and DDE are similar.

The estimated daily exposure dose calculated for a child ingesting DDT contaminated soils does not exceed (is 200 times less than) the ATSDR intermediate oral MRL health-based guideline of 0.0005 mg/kg/day.

ATSDR Child Health Initiative - Exposure Pathways and Children

ATSDR and DOH recognize the unique vulnerability of infants and children, and that they require special site-specific evaluation regarding exposure to environmental contaminants. Infants, children, and unborn fetuses may be at greater risk for potential exposure and adverse health effects compared to older children or adults. Children are more likely to engage in outdoor activities which put them into direct contact with contaminants in soil. Frequent hand- to-mouth activities account for increased exposure in young children via ingestion and dermal contact.

Pound-for-pound body weight, children drink more water, eat more food, and breathe more air than adults. Within the United States, children within the first six months drink seven times as much water (per pound) than the average adult.¹⁴ As a result, because of the unique

characteristics of children, given the same level of exposure, children receive a significantly higher contaminant dose than adults. For the purposes of this health consultation, children are defined as “the period from conception to maturity at 18 years of age, when all biological systems have matured.”¹⁵

Migrant farm workers and family members (including children) have been exposed to contaminants in groundwater and potentially exposed to contaminants present in on-site soils. Acute, intermediate, or chronic exposure to the highest level of manganese detected in on-site groundwater by a child would not likely result in any adverse non-carcinogenic health effects. Under the most conservative exposure scenario of a child ingesting the highest concentration of DDT detected in sub-surface soils on-site, the estimated daily exposure dose is well below the ATSDR intermediate oral MRL. Migrant farm workers and family members (including children) that may be exposed to the highest concentration of DDT in sub-surface soils are not likely to experience any non-carcinogenic health effects.

Conclusions

Based upon limited environmental monitoring data, the Gebber’s Farm site poses an indeterminate public health hazard. Further characterization of on-site soils and groundwater is needed to adequately evaluate the public health implications of exposure to each pathway. Dinoseb was detected in a supply well on-site during a SHA conducted in 1991, but was not detected in a groundwater sample collected in May 1997. Manganese was detected in a single groundwater sample collected from a supply well on-site at a concentration of 103 µg/L in May 1997.

Previous health consultations for the Gebber’s Farm site indicate human exposure to dinoseb has occurred in the past for migrant workers and family members living in trailers on-site which use the on-site supply well as a drinking water source. However, the estimated exposure dose from ingestion of dinoseb contaminated groundwater is well below the level at which adverse health effects occur. This exposure dose evaluation is based upon a single sample which is not adequate to evaluate the public health implications of the groundwater pathway. Chlorinated pesticides are also present in on-site soils and may result in exposure to migrant workers and family members living on-site. Past waste disposal practices (illegal dumping) which have occurred on-site indicate a strong likelihood that exposure may occur from direct contact with pesticide contaminated soils (DDT, DDE, DDD) as well as ingestion of dinoseb in groundwater.

Previous health consultations for the Gebber’s Farm site have indicated that pesticides and metals were identified in on-site soils and groundwater, but were below levels expected to result in adverse human health effects from exposure. However, soil and groundwater contamination at the Gebber’s Farm site has not been fully characterized.

Recommendations

Implement the following previous DOH health consultation recommendations which are still valid:

1. Monitor unfiltered drinking water supply well quarterly for at least one year. If pesticide contamination is detected continue routine monitoring of the supply well to ensure that farm workers and family members are not exposed to contamination at levels of public health concern.
2. Characterize the nature and extent of soil and groundwater contamination.
3. Identify water supply wells within a one-mile radius of the site. In the event further characterization of groundwater indicates contaminants in public or private wells, perform monitoring of identified wells.
4. Characterize the nature and extent of soil contamination on-site, particularly surface soils at a depth of 0 to 3 inches.
5. Additional environmental monitoring data collected to further characterize the Gebber's Farm site should be provided to the DOH Office of Environmental Health Assessments, Site Assessment Section for review.

Public Health Actions

The Public Health Action Plan (PHAP) for the Gebber's Farm site identifies action to be taken by DOH subsequent to the completion of this health consultation. The purpose of the PHAP is to ensure that this health consultation not only identifies public health hazards, but provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. The following public health actions have been developed based upon recommendations from the Gebber's Farm health consultation.

1. As additional environmental data becomes available, DOH will re-evaluate the site for necessary follow-up health activities using current environmental data.
2. DOH will re-evaluate and may expand the PHAP if community health concerns are identified. This PHAP will be evaluated annually unless information warrants more frequent evaluation.

CERTIFICATION

This (fill in) Health Consultation was prepared by the Washington Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

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References

1. Skagit County Department of Emergency Management memorandum to Department of Ecology Water Quality Office. October 13, 1989.
2. Washington State Department of Ecology Hazardous Waste Site Priority Scoring Worksheet. June 25, 1991.
3. Agency for Toxic Substances and disease Registry Health Consultation for Gebber's Farm site. Brewster, Okanogan County, Washington. Atlanta: ATSDR August 21, 1997.
4. Washington State Department of Ecology Memorandum to Mr. Dan Gebber regarding dump site located adjacent to farm worker camp site. February 27, 1997.
5. Agency for Toxic Substances and Disease Registry Health Consultation for Gebber's Farm site. Brewster, Okanogan County, Washington. Atlanta: ATSDR December 18, 1997.
6. Personal communication with Susan Bergdorff-Beery. Ecology site manager for the Gebber's Farm site. December 17, 1999.
7. Agency for Toxic substances and Disease Registry. Toxicological profile for Manganese. Atlanta, Georgia: September 1997.
8. US Environmental Protection Agency Integrated Risk Information System (IRIS). Information for Manganese (CAS #7439-96-5) was obtained via National Library of Medicine's TOXNET database. January 11, 2000.
9. Ibid.
10. Ibid.
11. Ibid.
12. Ibid.
13. Agency for Toxic Substances and Disease Registry Health Consultation for Gebber's Farm site. Brewster, Okanogan County, Washington. Atlanta: ATSDR August 21, 1997.
14. ATSDR Guidance on Including Child Health Issues in Division of Health Assessment and Consultation Document. July 2, 1998.
15. Ibid.

Appendix A: Figures

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Figure 1 - Gebber's Farm site location map

Figure 2 - Gebber's Farm detailed site map

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Appendix B: Tables

Table 1 - Contaminants of concern

Table 2 - Contaminants of concern compared with health guidelines

Table 1. Maximum Contaminant Concentrations in Soil and Groundwater						
	Soil (mg/kg)			Groundwater (µg/L)		
Contaminant	Concentration	Location	Comparison Value	Concentration	Location	Comparison Value
Manganese	ND	On-site soils	Child RMEG 7,000 mg/kg	*103 µg/L	Farm Workers Supply well	Child RMEG 50 (µg/L)
4,4'-DDT	190 µg/kg	On-site soils	Int. Child EMEG 30 mg/kg	ND	Farm Workers Supply well	Int. Child RMEG 5 ppb
4,4'-DDE	270 µg/kg	On-site soils	**Int. Child EMEG 30 mg/kg	ND	Farm Workers Supply well	***Int. Child RMEG 5 ppb
Dinoseb	ND	On-site soils	Child RMEG 50 mg/kg	***0.3 µg/L	Farm Workers Supply well	Child RMEG 10 (µg/L)

* - Sample collected during May 1997

** - Comparison value for DDT used for evaluation of DDE

*** - Sample collected during 1991 SHA

ND - Not detected

Table 2. Comparison of Estimated Exposure to Health-based Guidelines						
	Soil Health-based Guideline (mg/kg/day)			GW Health-based Guideline (mg/kg/day)		
Contaminant	Value (mg/kg/day)	Source	Guideline Exceeded?	Value (mg/kg/day)	Source	Guideline Exceeded?
Manganese			No	0.047	**Chronic Oral RfD (33%)	No
4,4'-DDT	0.0005	Int. Oral MRL	No			
4,4'-DDE	0.0005	*Int. Oral MRL	No			
Dinoseb			No	0.001	Chronic Oral RfD	No

* - Health guideline for DDT used for evaluation of DDE

** - Reflects modifying factor of 3 (33%) as suggested by IRIS when evaluating exposure to manganese from drinking water or soil.

